Electron-Capture Delayed Fission Properties of ^{244}Es

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Electron-capture delayed fission (ECDF) was studied in ^{244}Es, which was produced via the ^{237}Np(^{12}C,5n) reaction at a projectile energy of 81 MeV (on target). Reaction products were transported via a He/KCl gas-jet to our MG rotating wheel detection system. The wheel rotated every 30 s to position samples between six pairs of PIPS detectors that were directly above and below the wheel. After 120 min of continuous collection and counting, a new, clean wheel was placed in the MG.

Sixteen coincident fission events were detected after 36 h of beam time. The half-life of the fission events was 31 ± 10 s, very close to the reported half-life of 37 s for ^{244}Es[1]. Since the fission events in ECDF decay with the half-life of the parent nucleus, this measured half-life proves the parent was ^{244}Es.

The fission fragments showed a highly asymmetric mass distribution. The average pre-neutron total kinetic energy (TKE) of the fragments was 186 ± 19 MeV. The probability of delayed fission (P_{DF}) is defined as the ratio of the number of electron-capture (EC) events resulting in fission to the total number of EC events. Since ^{244}Cf has a 100% α-branch, the number of ^{244}Cf α-decays measured during the experiment is equivalent to the total number of ^{244}Es EC decays. A P_{DF} of (1.2 ± 0.4) x 10^{-4} was determined for ^{244}Es, which is consistent with previously reported values. Our research group has shown that the P_{DF} increases with Q_{EC}. This is seen in Fig. 3.

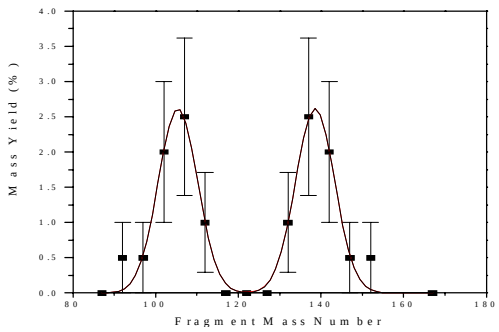

Fig. 1. Pre-neutron emission mass-yield distribution for the ECDF of ^{244}Es. The fissioning species is ^{244}Cf.

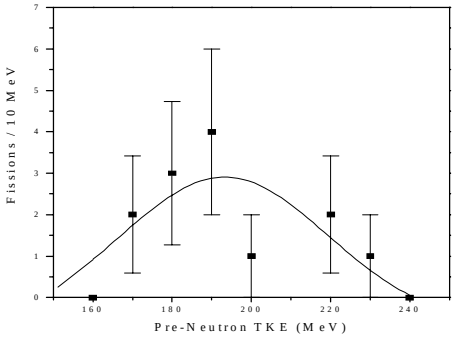

Fig. 2. Pre-neutron emission TKE distribution for the ECDF of ^{244}Es.

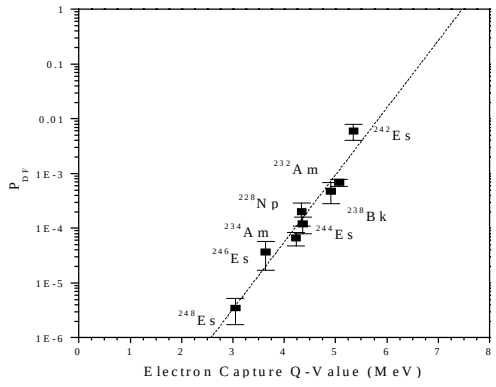

Fig. 3. Plot of the probability of delayed fission vs. Q_{EC} for nuclides studied by our group.

Footnotes and References

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[1]R. B. Firestone and V. S. Shirley, Editors, *Table of Isotopes*, 8th ed. (Wiley Interscience, New York, 1996).